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(54) Shaving apparatus.

(57) A shaving apparatus has at least one shaving unit (2) which comprises an external shaving member (3) and an internal shaving member (4) which is rotatably drivable relative to the external shaving member, the external shaving member having an annular wall portion (5) with lamellae (6) which extend in substantially radial directions and between which hair-entry apertures (7) are formed, the internal shaving member comprising cutters (9). In order to improve the shaving performance the shaving apparatus is characterized in that the average circumferential velocity of the cutter is between 0.4 and 1.2 m/s.

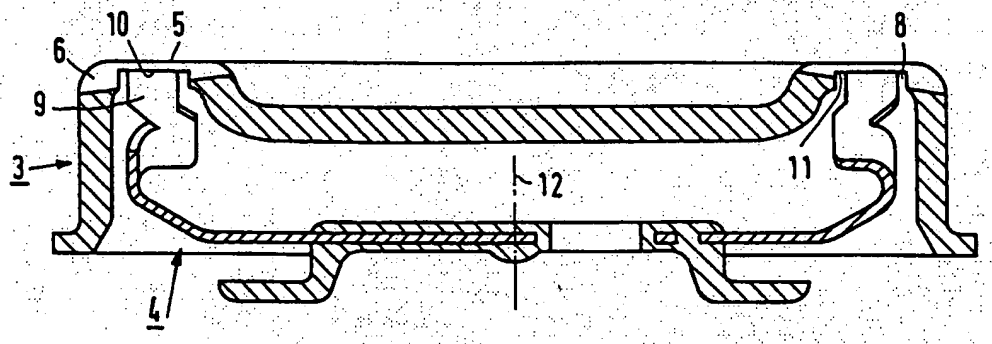

FIG.2

EP 0 652 087 A1

A shaving apparatus having at least one shaving unit comprising an external shaving member and an internal shaving member which is rotatably drivable relative to the external shaving member, the external shaving member having an annular wall portion with hair-entry apertures, and the internal shaving member having cutters comprising cutting edges which describe a path adjoining the inner side of the annular wall portion of the external shaving member.

A rotary shaving apparatus of the type defined in the opening paragraph is disclosed in, for example, US-A-4,675,998 (PHN 11161).

In such shaving apparatuses the shaving performance could be improved, i.e. the hairs could be severed closer to the skin, by reducing the thickness of the wall portion in which hair-entry apertures are situated. However, this would be at the expense of the so-called skin comfort. This is because the skin would then protrude slightly further into the path of internal shaving member, as a result of which the skin could be injured and/or a slightly irritating effect could arise.

It is an object of the invention to improve the shaving performance of the shaving apparatus of the type defined in the opening paragraph, in such a way that the skin comfort remains satisfactory or is even improved.

To this end the shaving apparatus in accordance with the invention is characterized in that the average circumferential velocity of the cutter is between 0.4 and 1.2 m/s.

The invention is based on the recognition of the fact that the mass inertia of the skin portion which deformed during the shaving process can play an important part in the skin comfort of the shaving apparatus. Pursuant to this it has been established by experiment that a lower speed of the internal shaving member is far more comfortable to the skin. This enables the thickness of the wall portion with the hair-entry apertures to be reduced while the skin comfort is maintained or even improved in comparison with the rotary shavers known until now. A thinner wall portion results in the hairs being severed closer to the skin and hence in a better shaving performance.

Cutting hairs requires energy, which is delivered by the motor. Sometimes hairs are severed simultaneously or immediately after each other. During cutting the rotating internal shaving member is subjected to forces which inter alia tend to urge the shaving member out of its path and also tend to slow down the shaving member. Cutting a hair is expedited when the internal shaving member is dynamically stable, which means that during cutting the cutting edges as far as possible remain in the path adjoining the lower side of the external shaving member and, moreover, that the speed remains fairly constant. This has lead to a balanced construction as described in the above-mentioned document and as used in the present rotary shaving apparatus. In view of this, the speed of the internal shaving member is selected as high as possible. The impact between the internal shaving member and a hair to be severed is smaller at a high cutting speed than at a low cutting speed because the duration of the impact is shorter. A high speed is more favourable for the stability of the shaving system. In such rotary shaving apparatuses the circumferential velocity customary until now is therefore between 2 and 3 m/s. In shavers of older types the speed is even higher.

Tests have demonstrated that skin injury may arise in that the internal shaving member in fact nicks the skin (see Fig. 3). One of the causes of this could be that the skin has not only a certain mass inertia but also visco-elastic properties. Both properties lead to a skin bulge offering more resistance to deformation as the rate of deformation by the shaving member increases. As a result of this, a shaving member having a higher speed is more likely to penetrate the skin than a shaving member with a lower speed. A lower speed is more comfortable to the skin. A test has revealed that a cutter speed of 1.2 m/s already yields a distinct improvement in skin comfort as compared with a speed of 2 m/s.

Preferably, the cutter frequency is higher than 300.

Herein, cutter frequency is to be understood to mean the number of times per second that the cutting edge of a cutter moves past the same hair-entry aperture. It has been found that at a speed of 0.4 m/s and a cutter frequency below 300 the time needed for shaving increases perceptibly. However, the reduction of the speed is subject to limitations. In current types of rotary shavers this frequency is between 450 and 550. This means that if the cutter speed is reduced the number of cutters should be increased proportionally in order to maintain the same frequency. Increasing the number of cutters means that the spacing between the cutters becomes smaller. However, this is subject to limitations with respect to

- the capture of hairs: a hair should still be capable of assuming an upright position between two cutters
- soiling: accumulation of hair cuttings between the cutters
- the manufacture.

In the drawings:

Fig. 1 is a perspective view of a shaving apparatus comprising three shaving units, in which the invention is used,

Fig. 2 is an enlarged-scale cross-sectional view of a shaving unit shown in Fig. 1, and

Fig. 3 represents diagrammatically a possible mechanism of skin injury.

The shaving apparatus has a housing 1 with three shaving units 2. A shaving unit 2 comprises an external shaving member 3 and an internal shaving member 4, which is rotatably drivable relative to the external shaving member. In known manner the internal shaving member can be driven by means of an electric motor, not shown, which is accommodated in the housing.

Each external shaving member 3 has a substantially annular wall portion 5 with lamellae (6) which extend in substantially radial directions and between which hair-entry apertures 7 are formed. The inner side of the external shaving member has an annular groove 8 at the location of the wall portion 5. The internal shaving member 4 comprises cutters 9 having cutting edges 10, which describe a path (14) adjoining the inner side 11 of the groove 8 in the external shaving member 3. The internal shaving member 4 can be driven by a motor about an axis of rotation 12.

Fig. 3 illustrates a mechanism which may be the possible cause of skin injury. The skin penetrates into the hair-entry apertures and forms a skin bulge 13. The top of this skin bulge is situated in the path 14 of the cutting edges 10. During shaving the cutter 9 presses against the skin bulge 13 and deforms it. However, it also occurs that the cutting edge 10 penetrates the skin and in fact nicks the skin (15). Such a skin injury is more likely to occur at a higher speed of the cutter than at a lower speed.

Claims

1. A shaving apparatus having at least one shaving unit comprising an external shaving member and an internal shaving member which is rotatably drivable relative to the external shaving member, the external shaving member having an annular wall portion with lamellae which extend in substantially radial directions and between which hair-entry apertures are formed, and the internal shaving member having cutters comprising cutting edges which describe a path adjoining the inner side of the annular wall portion of the external shaving member, **characterised in that**, the average circumferential velocity of the cutter is between 0.4 and 1.2 m/s.

2. A shaving apparatus as claimed in Claim 1, **characterised in that** the cutter frequency is higher than 300.

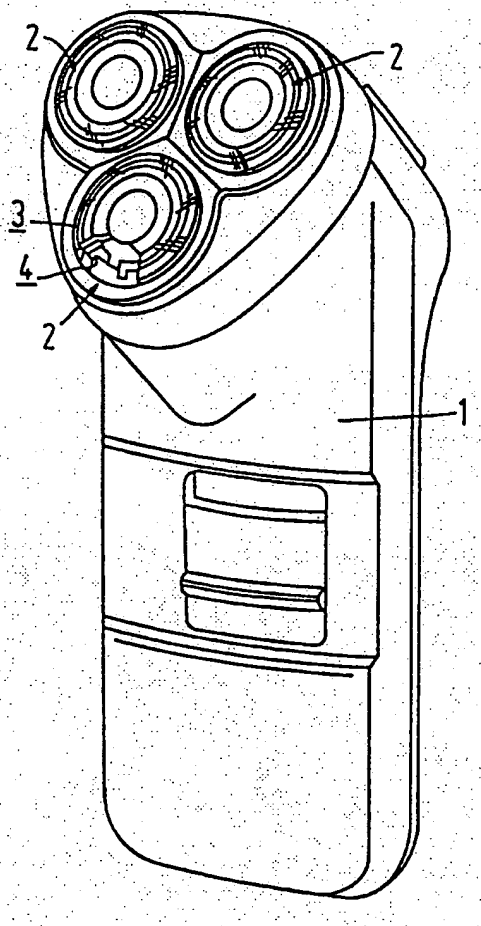

FIG.1

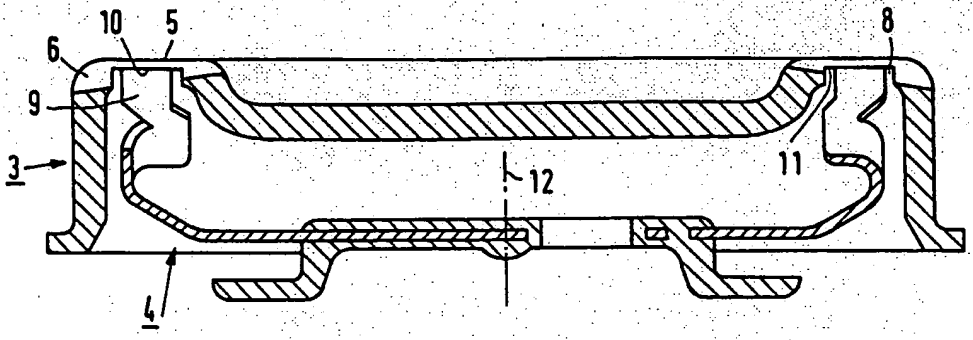

FIG.2

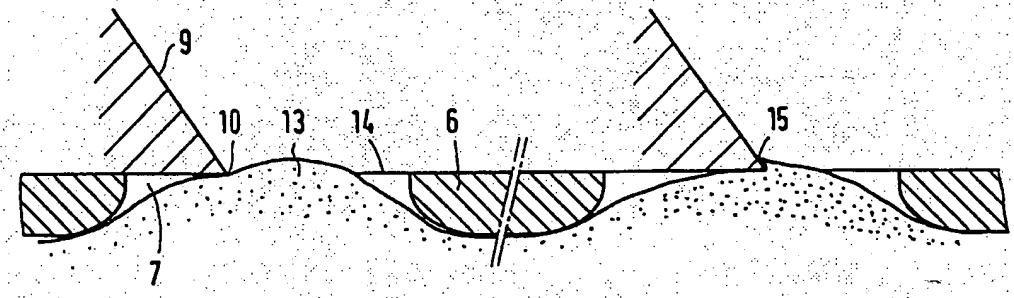

FIG.3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 94 20 3145

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	EP-A-0 322 072 (PHILIPS PATENTVERWALTUNG GMBH) 28 June 1989 * column 4, line 37 - column 5, line 13; figures *	1,2	B26B19/14
A	US-A-4 294 010 (E.N. CHEN) 13 October 1981 * column 3, line 65 - column 4, line 23; figures *	1,2	
A	FR-A-1 395 703 (P. FABRY) 8 March 1965 * the whole document *	1,2	
A	EP-A-0 378 266 (N.V. PHILIPS GLOEILAMPENFABRIEKEN) 18 July 1990 * column 1, line 50 - column 3, line 50; figures 1-5 *	1,2	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

B26B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	20 January 1995	Raven, P

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

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